



# Cisco Voice Infrastructure and Applications Solution

*Enabling a broad portfolio of packet-voice services*

## Executive Summary

Since the mid-1990s, enterprises have been moving their telecommunication offerings from traditional voice networks—such as leased tie lines and private branch exchanges (PBXs)—to voice-over-IP (VoIP) technology. Today's forward-looking service providers and enterprises are choosing packet-based voice networks as the optimal way to deliver call transport services. Lower hardware and software costs, advances in voice quality of service (QoS), and the inherent scalability of these packet-based networks give service providers an advanced packet-based medium that both connects to and bypasses the public switched telephone network (PSTN) to transmit voice traffic.

The Cisco Voice Infrastructure and Applications (VIA) solution is an open, standards-based VoIP infrastructure that enables a broad portfolio of packet-voice services. It is designed for service providers that seek to increase revenue, build customer loyalty, and boost profits by adding call transport and a variety of other services such as pre- and postpaid calling card services and messaging to their service portfolios. This solution also lends itself well to carriers that offer international transit services. Support for industry-standard signaling protocols such as H.323, Media Gateway Control Protocol (MGCP), and Session Initiation Protocol (SIP) make it easy to link a service provider's network with a large number of interconnect partners.

As service providers look for ways to expand their businesses, they are targeting enterprises with new and innovative services that cannot easily be offered using traditional time-division multiplexing (TDM) circuit-switching equipment. With minimal upgrades to existing packet-based data networks, service providers can use the Cisco VIA solution to open the door to new markets and a variety of new services (such as unified communications), increasing revenue by offering voice and data services on a common, packet-based infrastructure.

## Market Dynamics

Escalating demand for packet-voice traffic is caused by many factors, including rising demand for low-cost voice services, the availability of inexpensive international cross-border rates for IP service providers, and ambiguous regulations in international packet-based voice traffic. These factors are causing a shift from legacy TDM to packet-voice networks.

## IP Telephony Services

Packet-voice services provide an attractive alternative to traditional, circuit-based, PSTN call transport services. The cost of delivering packet-voice calls is generally less than PSTN calls, as shown in Table 1.

**Table 1** Top VoIP Routes and Per-Minute Retail and Wholesale Rates (Source: TeleGeography, 2001)

Country	PSTN retail	PSTN wholesale	VoIP Retail	VoIP wholesale
United States to Mexico	\$0.39	\$0.19	\$0.19	\$0.12
Indonesia	\$0.53	\$0.28	\$0.36	\$0.19
Malaysia	\$0.44	\$0.15	\$0.19	\$0.06
South Africa	\$0.53	\$0.31	\$0.30	\$0.20
Russia	\$0.47	\$0.28	\$0.21	\$0.12

Note: For up-to-date wholesale prices offered in the spot market, refer to the following Internet sites:

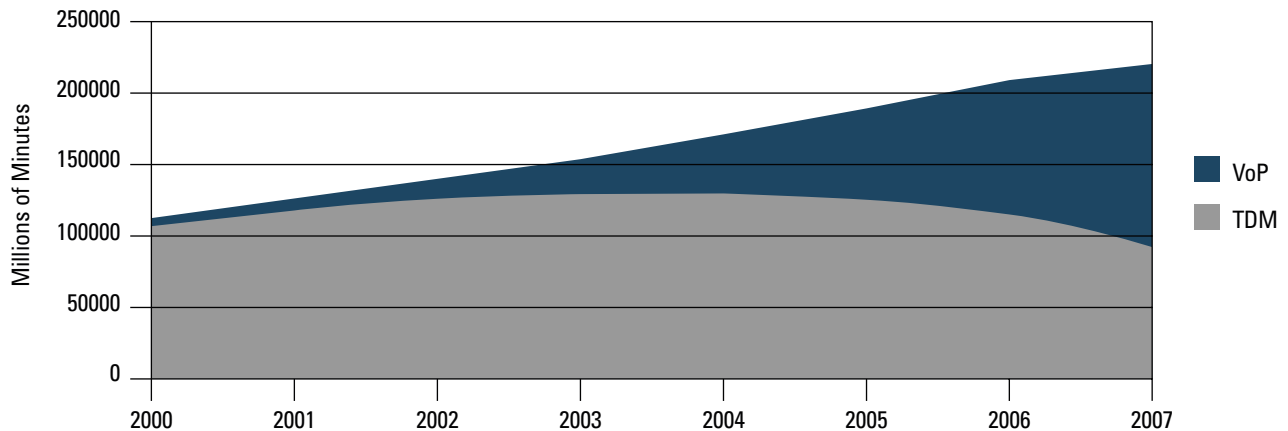
[http://www.arbinet.com/default\\_frame.asp](http://www.arbinet.com/default_frame.asp) for both PSTN and VoIP spot rates

<http://www.min-x.com/rates.html> for VoIP spot rates

Probe Research (2002) estimates that worldwide VoIP transit traffic is growing from 12 billion minutes of use (MOU) in 2000 to over 900 billion MOU in 2007. International VoIP is growing from 6 billion MOU in 2000 to 123 billion MOU in 2007. In 2002, VoIP international traffic is estimated to be 18 billion minutes, or 13 percent of total international traffic. This represents an impressive increase from the late 1990s, when VoIP was less than one percent of the world's international traffic. Clearly, momentum is growing in this nascent market (refer to Figure 1).

**Figure 1**

International TDM and Voice-over-Packet Traffic (Probe Research, Inc., August 2002)

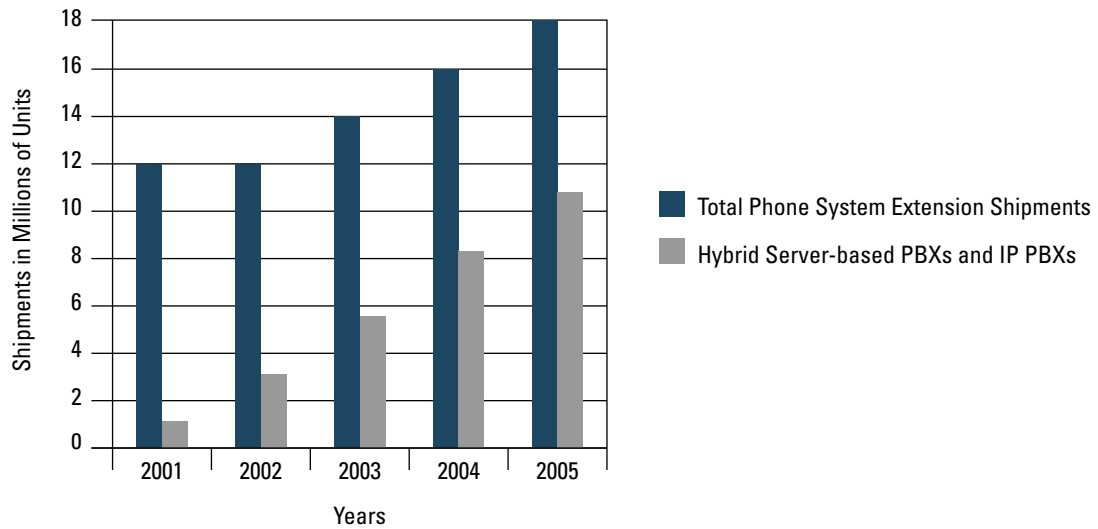


## IP PBX Services

As enterprises adopt IP and IP PBX technology, service provider networks must adapt to customer needs. Figure 2 indicates the fast adoption of IP in the enterprise voice market, with IP-based systems growing from 9 percent in 2001 to 38 percent in 2005. This adoption represents a decisive shift that service providers seeking to provide business voice services cannot ignore.

**Figure 2**

IP U.S. Shipment Forecast (Yankee Group 12/01)

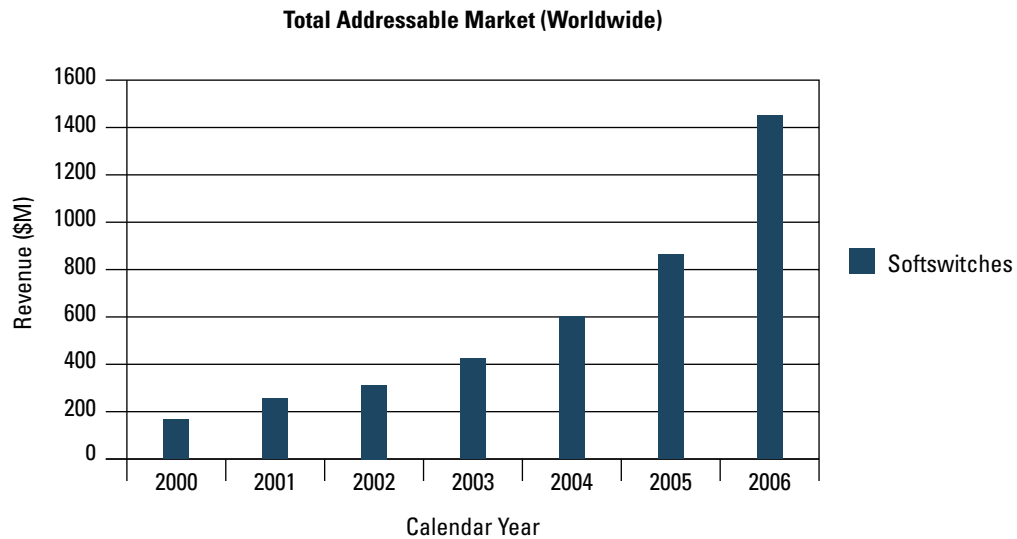


### Softswitch Deployment—Transit Services

IP has moved into the transit space and will grow very quickly with burgeoning IP usage in the enterprise. To keep up with the demand for IP telephony transport from enterprise customers, Infonetix expects the number of transit softswitches deployed to grow significantly between 2000 and 2006, as shown in Figure 3.

**Figure 3**

Revenue for Transit Softswitches Deployed Worldwide (Infonetix 2002)



### VIA Supported Services

The Cisco service provider voice solutions are based on voice-over-packet technologies, where the underlying network may have an ATM or IP core. Protocol flexibility and an open, standards-based infrastructure in Cisco solutions allow operators to develop multiservice networks capable of carrying voice, data, and video on a multiservice platform. Although Cisco has many options for transport, the Cisco VIA solution is designed for IP networks.

Services enabled by Cisco VIA include national and international transport services, pre- and postpaid calling card services, termination services for telephony application service providers (ASPs), voice mail and unified communications, and dial access.

### **National and International Transport Services**

With Cisco VIA, service providers can use packet-voice networks to transport traffic to just about any point in the world. Cisco's commitment to delivering flexible, standards-based solutions anchors a broad set of product offerings for the national and international call transport services market. Cisco VIA includes sophisticated routing mechanisms that automatically identify the most efficient and reliable routes to achieve superior network utilization, lowering capital expense requirements while extending market opportunities.

The Cisco VIA solution also enables service providers to provide reliable, high-quality toll and toll-free retail services to consumers and businesses and to partner with wholesale terminating carriers to transport voice traffic that originates on their networks.

### **Prepaid and Postpaid Calling Card Services**

The Cisco VIA solution supports pre- and postpaid calling card services, including the following:

- Interactive-voice-response (IVR) capabilities, including support of standard voice Extended Markup Language (VXML) automated speech recognition (ASR) and text to speech (TTS) for increased customer service satisfaction
- A telephony user interface similar to familiar card services applications on the PSTN
- Support for multiple languages and multicompany brandings or announcement messages on the same network
- Card recharging, balance transfer, and personal-identification-number (PIN) change.

### **Termination Services for Telephony Application Service Providers**

Many of the world's largest wholesale voice carriers depend on the Cisco VIA solution to offer termination services to ASPs. This makes it possible for the ASPs to offer a broad variety of services such as PC-to-phone calls, phone-to-phone calls, and unified messaging services.

The Cisco VIA solution offers broad support for industry-standard signaling protocols, protecting service provider investments as technology shifts occur. Modular gateways accommodate a range of interconnect densities, allowing the solution to scale simply by adding extra line cards.

### **Voice Mail and Unified Communications Services**

The Cisco VIA solution has a full range of messaging applications, including voice mail, unified messaging, and unified communication.

Voice-mail products offer the services of standard voice-mail functions except on an IP platform. Being IP based, service providers get the benefits of IP economics as well as a platform that can expand to include unified messaging, unified communication, instant messaging, multimedia messaging, and video messaging services.

Unified messaging gives ubiquitous access to voice, fax, and e-mail on various devices, including wireline or wireless phones, and Internet-enabled mobile and desktop platforms. Generally the messages are asynchronous in nature, where the messages are stored for later retrieval.

Unified communications includes unified messaging and adds various real-time, synchronous services such as single number reach (find me or follow me), rule-based call filtering, multimodal instant messaging, live reply, and personal attendant services.

### **Dial Access Services**

Cisco VIA allows service providers to offer high-volume Internet access, regional and branch-office connectivity, and corporate virtual private networks (VPNs), in either a wholesale dial or retail dial business model. A wholesale dial service provider owns and operates the dial access infrastructure and leases ports to retail ISPs and enterprises. ISPs and enterprises benefit because they lease ports from the wholesale service provider rather than owning a capital-intensive infrastructure, and can focus on their core strengths: marketing and acquiring and managing customer relationships.

With support for guaranteed service-level agreements and the latest modem standards (V.92 and V.44), service providers can differentiate themselves, create additional revenue, and improve customer loyalty. With V.92 and V.44, dialup users experience: quicker connection to the Internet, faster downloading of Internet pages, and the ability to make or take calls while connected to the Internet.

## Cisco Value Proposition

Cisco VIA enables service providers to take advantage of packet network investments by quickly building multiservice networks and deploying revenue-generating voice and data services. The solution combines manageability, scalability, reliability, and QoS to enable a wide selection of enhanced services. Cisco has the widest geographic deployment of packet-voice solutions, and the world's largest packet-voice networks are based on Cisco products and expertise (including China Unicom and iBasis). Key benefits to service providers are summarized as follows:

- *Fast time to market*—Getting billable minutes onto the network quickly may be the single most important success factor for service providers. Cisco's standards-based architecture provides packet-voice service providers with a wide selection of interconnect capabilities, enabling fast global reach.
- *Network efficiency*—Combining both voice and data on the same network eliminates the need to maintain, provision, and monitor multiple networks.
- *Interoperability*—To maximize market reach, service providers need to support varying interconnect characteristics. The flexibility of the Cisco architecture increases the number of retail carrier profiles that wholesale service providers can target. Inherent support for industry-standard protocols such as H.323, SIP, and MGCP make it easy to link a service provider's network with a broad number of interconnect partners.
- *Investment protection*—Cisco VIA protects carrier investments by ensuring integration with future equipment designs and services. Cisco VIA has an open, standards-based infrastructure that is separate from the call control plane to allow the flexibility of supporting either Cisco or partner call control. Therefore, by providing open, standard interfaces, the growth of the system is not limited to one vendor's design or development. Built-in back-office system interfaces reduce system integration and operations costs, while a simplified Web-based element management system accelerates training of operations personnel. Also, Cisco's open, standards-based offering allows service providers to rapidly customize and evolve the network with new value-added applications and services as required by end users.
- *Low cost of ownership*—By offloading traffic from existing investments using TDM onto an IP-based infrastructure, service providers can alleviate congestion in expensive traditional networks. The Cisco solution significantly lowers the total cost of ownership with an efficient, easy-to-manage packet network. It also enables low-cost entry into new markets.
- *Inherent manageability*—Cisco VIA simplifies management of day-to-day operation, billing, and settlement issues. An optional suite of network management tools, based on the Cisco Internet Operations Support System (OSS) strategy and architecture, is available, tailored specifically to the needs of service providers. The Cisco Internet OSS for Voice over IP: Infrastructure Manager is an integrated set of network management applications that provide service fulfillment, service assurance, and usage reporting data for Cisco's VIA service offerings.
- *Reliability*—Cisco VIA is designed to uphold the requirements of carrier networks. All core components of the solution are designed to meet the strict in-service times demanded by carriers—99.999-percent availability or no more than 5.25 minutes of downtime per year. Additionally, these components are packet based, and can be strategically distributed across a WAN to ensure that there is no single point of failure.
- *Exceptional QoS*—For years, Cisco has been honing the mechanisms for delivering excellent voice quality through standards adoption, internal engineering efforts, and acquisitions. Advances in prioritization and queuing techniques have created a service quality comparable to the PSTN.
- *Opportunities for new revenue*—Extensive experience with service providers makes Cisco the ideal candidate to help carriers quickly generate revenue from voice and data services. Cisco offers solutions for enhanced services that provide a strategic edge to packet-voice wholesalers. Assistance in the areas of managing network design, growth, and capacity planning equate to higher quality and faster time to market.

- *Access to enterprise customers*—Most enterprises already rely on Cisco equipment for their local-area network. Service providers can tap into this enormous base of enterprise customers to offer packet-voice services that complement and extend their existing service offerings. Cisco’s packet-voice equipment can be used in tandem with the largest class of gateways and routers in the market place.

### Support for Multiple Protocols

Today’s packet telephony traffic traverses networks that rely on a variety of signaling protocols, including H.323, MGCP, and SIP. Recognizing the need for solutions that can interconnect and interoperate with other networks regardless of the signaling protocol used, Cisco voice gateways and the Cisco PGW 2200 softswitch support all these standard protocols.

Cisco’s multiprotocol strategy has several facets. Cisco has implemented support for SIP in its gateway product lines that have existing support for H.323 and MGCP. This extension of Cisco gateway functionality has allowed Cisco to take advantage of the rich features of these gateways, including a broad variety of coder-decoder (codec) support, VXML, sophisticated QoS algorithms, and existing operations, administration, and maintenance (OA&M) capabilities.

Also, Cisco VIA supports the Cisco PGW 2200 softswitch, which allows for interconnecting H.323 and SIP while controlling the gateways using MGCP. This interconnection ensures that the core infrastructure will be flexible enough to evolve as service providers’ needs change.

### Architecture Overview

The Cisco VIA solution offers a full range of products to support both distributed (H.323 and SIP) and centralized (MGCP) network architectures. Collectively, these products provide PSTN interconnect, call routing, call detail records (CDRs), and enhanced services such as IVR (VXML) and interconnect to intelligent network services. These and other solution components are described in Table 2. Refer to Figure 4 for an architecture diagram.

**Table 2** Cisco VIA Solution Details Components

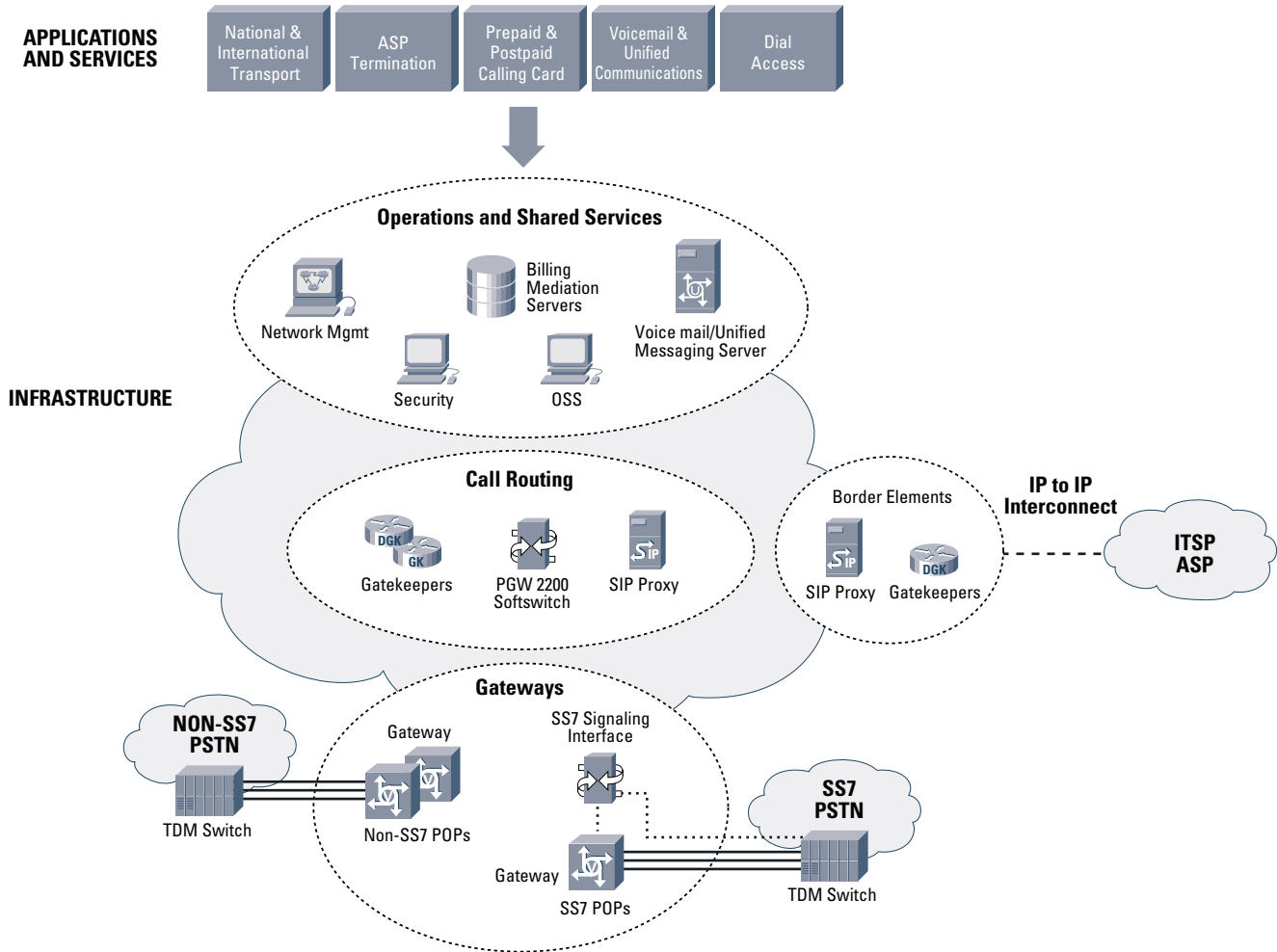
Components	Role	Description	Cisco or partner products
Media gateways	Required in packet-voice networks	<p>Cisco VIA supports a range of small to large-scale gateways that support a broad range of codecs for high-quality voice transit, as well as fax, modem, and dual tone multifrequency (DTMF) transit.</p> <p>The gateways support an IVR function that provides voice prompts and digit collection or speech input for user authentication and call destination identification for applications such as pre- and postpaid calling card services. These products support standard VXML and customized Toolkit Command Language (TCL) scripts. Optional speech recognition and text-to-speech capabilities are available.</p>	<ul style="list-style-type: none"> <li>• Customer premises gateways: <ul style="list-style-type: none"> <li>– Cisco 1750 Modular Access Router</li> <li>– Cisco 2600 Series multiservice platforms</li> <li>– Cisco 3600 Series multiservice platforms</li> <li>– Cisco 7200 Series voice gateways</li> </ul> </li> <li>• Midrange service provider gateways: <ul style="list-style-type: none"> <li>– Cisco AS5000 universal gateways</li> </ul> </li> <li>• High-end service provider gateways: <ul style="list-style-type: none"> <li>– Cisco MGX<sup>®</sup> 8000 Series of voice gateways</li> </ul> </li> </ul>

**Table 2** Cisco VIA Solution Details Components

Components	Role	Description	Cisco or partner products
H.323 gatekeepers	Optional	Used to scale larger H.323 wholesale networks, Cisco gatekeepers provide address translation, admission control, resource monitoring, bandwidth management, and zone management. These products offer cost-effective routing, resource management for increased availability, and support for alternate gatekeepers for greater reliability.	<ul style="list-style-type: none"> <li>• Cisco 2600 Series multiservice platforms</li> <li>• Cisco 3600 Series multiservice platforms</li> <li>• Cisco 3700 Series multiservice platforms</li> <li>• Cisco 7200 Series multiservice platforms</li> <li>• Cisco 7400 Series multiservice platforms</li> </ul>
H.323 directory gatekeepers	Optional	Used to scale a wholesale network to large sizes, directory gatekeepers provide inter-regional call routing. These products enable cost-effective scaling, with dedicated call throughput and alternate directory gatekeepers for increased reliability.	<ul style="list-style-type: none"> <li>• Cisco 3600 Series multiservice platforms</li> <li>• Cisco 3700 Series multiservice platforms</li> <li>• Cisco 7200 Series multiservice platforms</li> <li>• Cisco 7400 Series multiservice platforms</li> </ul>
Cisco SIP proxy servers	Optional	Used to scale SIP wholesale networks, Cisco SIP proxy servers provide route management and admission control.	<ul style="list-style-type: none"> <li>• Cisco SIP Proxy Server</li> </ul>
Softswitch	Required in MGCP networks	Used to provide centralized call control in MGCP networks, the softswitch provides number analysis, advanced routing, and carrier-class CDRs. Additionally, the softswitch supports an H.323 and SIP interface for interoperability with other IP-based networks. The signaling link terminal is integrated into the Cisco PGW 2200.	<ul style="list-style-type: none"> <li>• Cisco PGW 2200 (call control mode)</li> </ul>
Signaling controller	Optional	Used to provide a Signaling System 7 (SS7) interface for Cisco IOS® call control environments, the signaling controller allows SS7 connectivity to the Cisco IOS control gateway. The signaling controller provides ISDN User Part (ISUP) transparency for H.323 networks, and has limited signaling transparency for SIP networks. The signaling controller supports both A and F links and is ideal for small and large network deployments.	<ul style="list-style-type: none"> <li>• Cisco PGW 2200 (signaling control mode)</li> <li>• Cisco Signaling Link Terminal (SLT) (note: the SLT is integrated into the Cisco AS5350 and AS5400 gateways)</li> </ul>
Billing mediation servers	Recommended	Ecosystem partner OSS servers interface with Cisco gateway, gatekeeper, SIP proxy server, and PGW 2200 components through the various accounting interfaces used by these network elements.	<ul style="list-style-type: none"> <li>• See <a href="http://www.cisco.com/go/telephony">www.cisco.com/go/telephony</a> for partner information</li> </ul>
Trivial File Transfer Protocol (TFTP) servers	Optional	These servers are used to store audio files, Cisco IOS Software or configuration files, dial plans, and so on.	<ul style="list-style-type: none"> <li>• Any standard TFTP server, such as Windows NT or 2000, or Solaris</li> </ul>
Management systems	Optional	Both Cisco Internet OSS and third-party network management systems are supported, including element management systems and network management systems.	<ul style="list-style-type: none"> <li>• See <a href="http://www.cisco.com/go/telephony">www.cisco.com/go/telephony</a> for partner information</li> <li>• See <a href="http://www.cisco.com/go/sposs">http://www.cisco.com/go/sposs</a> for information on Cisco's Internet OSS</li> </ul>

**Figure 4**

Voice Infrastructure and Applications Architecture



### Cisco Internet OSS and Network Management Systems

Service providers need robust management tools to lower network operational costs and to ensure the highest QoS to end-users. As an optional component to the VIA solution, Cisco offers a complete suite of Internet OSS and network management tools tailored specifically to the needs of service providers. The Cisco Internet OSS and network management solutions address three critical functions that can be used on an as-needed basis:

- *Fault management*—For the collection of alarm messages from the network, including alarm correlation and filtering
- *Performance management*—For the collection and presentation of performance data in a consistent format
- *Configuration management*—To facilitate network provisioning and simplify common operations tasks

### Service and Support

In today's increasingly complex marketplace, two things separate service providers that simply survive from those that succeed: time to market and operational efficiency. With this in mind, Cisco has created a comprehensive suite of support services designed to help service providers speed the development and release of revenue-generating products and improve the overall efficiency of network operations. Cisco Service and Support offerings help service providers prosper throughout the network life cycle by providing access to:

- Expert resources
- Best-practices methodologies

- End-to-end operational support
- Cutting-edge tools
- Best-in-class partnerships

Cisco is dedicated to providing best-of-class, end-to-end packet telephony networking solutions for anyone seeking to use IP to deliver and receive information, communication, and entertainment through data, voice, and video. Enabling a variety of applications, Cisco packet-voice solutions offer unmatched scalability, security, flexibility, and manageability. These solutions are backed by proven service and support programs designed to help service providers build, maintain, and profit from the deployment of world-class networks.

### The Cisco Service Carrier Community Program

Signing up business partners to terminate voice traffic in different countries is an important step in creating a viable wholesale call transport service. A wholesale provider must cover a comprehensive calling area if it is to attract many retail voice service providers. To terminate calls, a wholesale terminating carrier can work with in-country business partners that use the PSTN or a packet-voice network. It is not difficult for a wholesale packet-voice provider to demonstrate its value to a potential local partner, because the wholesaler brings additional traffic to the partner's network.

For service providers that want to grow their global footprint and increase voice traffic on their networks, the Cisco Service Carrier Community program offers business tools and partnering events that help members meet and exchange traffic. The program helps carriers establish worldwide interconnect relationships and business alliances throughout the carrier community. Additional information is available at <http://www.cisco.com/go/cscg>.

### Conclusion

The Cisco VIA solution is the industry's most widely deployed VoIP infrastructure, with proven benefits to service providers that wish to offer traditional and new voice services on a packet-based network.

When building VoIP networks, it is critical to deploy a best-in-class, open, standards-based IP network to ensure that the network can evolve as end-users' needs change. Cisco VIA is that underlying architecture, and it is flexible enough to support multiple call control protocol options as well as new and traditional services for the assurance of investment protection and continued revenue generation.

Cisco is a Fortune 100 company with years of experience in providing service providers with packet networks that support both data and voice services. This solid position gives service providers confidence that they are dealing with a vendor that will be in this business for years to come.

For more information about the Cisco VIA solution, visit <http://www.cisco.com/go/telephony>.



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